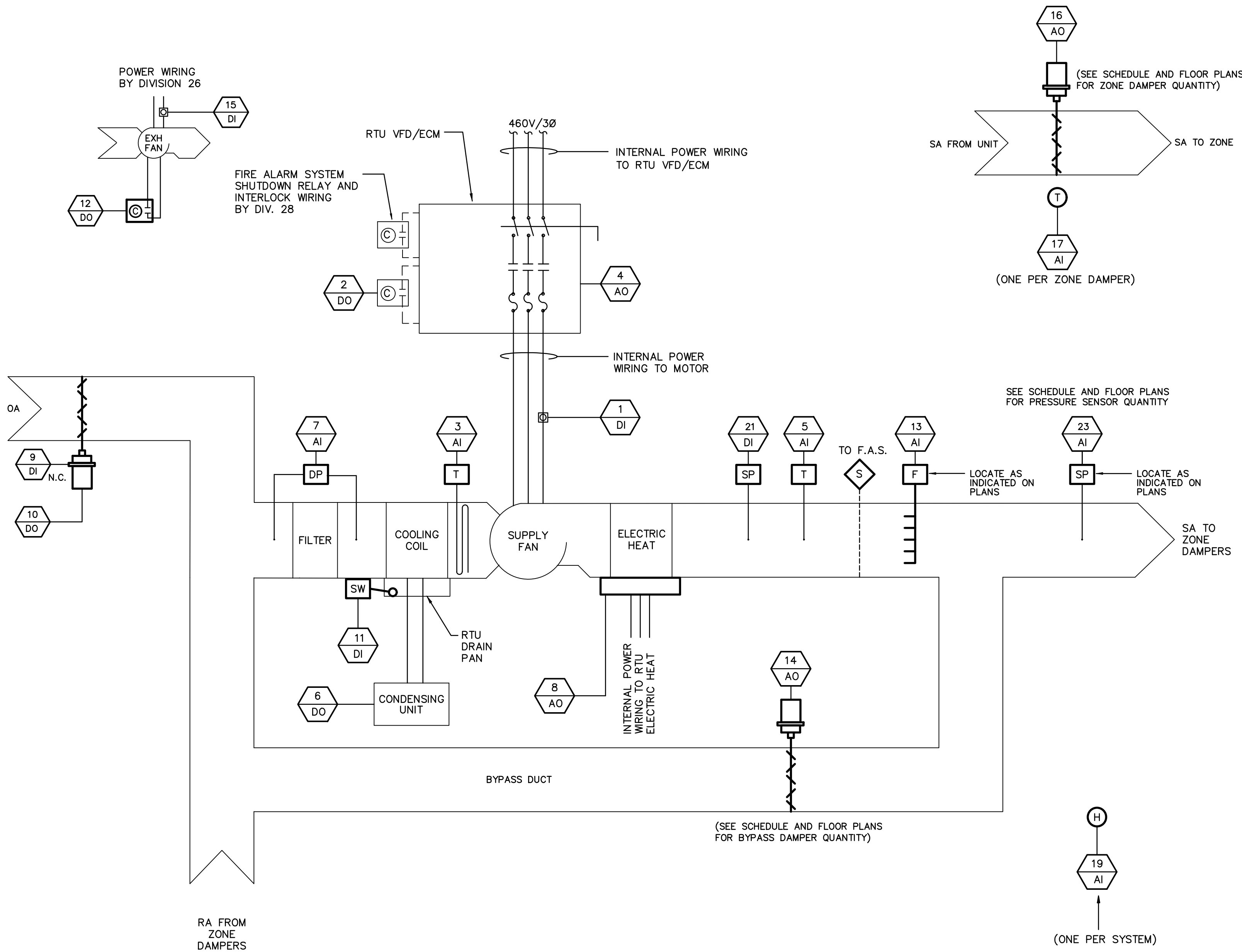


## SEQUENCE OF OPERATION

EXISTING AIR COOLED ROOFTOP UNIT – MULTI-ZONE CONSTANT AIR VOLUME WITH BYPASS AND ZONE DAMPER VVT SYSTEM:

- OCCUPANCY SCHEDULE: A TIME OF DAY SCHEDULE SHALL BE CONFIGURED AT THE BUILDING MANAGEMENT SYSTEM (BMS) REFLECTING BUILDING OCCUPANCY WITH OCCUPIED AND UNOCCUPIED OPERATIONAL MODES. OCCUPIED AND UNOCCUPIED MODE SCHEDULES SHALL BE ADJUSTABLE. THE CONTROL CONTRACTOR SHALL COORDINATE SCHEDULING REQUIREMENTS WITH THE OWNER.
- START/STOP: A HAND-OFF-AUTO (H-O-A) SWITCH SHALL BE PROVIDED FOR LOCAL CONTROL OF THE ROOFTOP UNIT (RTU) SUPPLY FAN (SF) START/STOP OPERATION. IN THE HAND POSITION THE RTU SF SHALL START. IN THE OFF POSITION THE RTU SF SHALL STOP. IN THE AUTO POSITION THE RTU SF SHALL START EITHER IN THE OCCUPIED MODE OR WHEN SPACE CONDITIONS EXCEED THE SETUP/SETBACK TEMPERATURE AND/OR HUMIDITY SETPOINTS IN THE UNOCCUPIED MODE.
- OPTIMUM START: AN OPTIMUM START ROUTINE SHALL BE PROVIDED THAT ADJUSTS THE OCCUPIED MODE START TIME OF THE RTU. THE BMS SHALL CALCULATE AN OPTIMUM START TIME BASED UPON DRUM START, AN OPTIMUM START ROUTINE SHALL BE PROVIDED THAT ADJUSTS THE OCCUPIED MODE START TIME OF THE RTU. THE BMS SHALL CALCULATE AN OPTIMUM START TIME BASED UPON THE OUTDOOR TEMPERATURE, ZONE TEMPERATURES, AND HISTORICAL OPERATING DATA. FOR EACH DAY WHERE OCCUPIED PERIODS ARE SCHEDULED, THE PROGRAM SHALL CALCULATE THE START TIME IN ORDER TO SUFFICIENTLY PRE-COOL OR PRE-HEAT THE SPACE TO ACHIEVE SPACE SETPOINT TEMPERATURE CONDITIONS AT THE BEGINNING OF THE OCCUPIED MODE. DURING THIS PERIOD.
- UNOCCUPIED MODE OVERRIDE: A TIMED LOCAL OVERRIDE (TLO) SHALL BE AVAILABLE VIA THE OPERATOR'S WORKSTATION AND ON ZONE SPACE TEMPERATURE SENSORS (ADJUSTABLE). WHEN THE HOA SWITCH IS IN THE AUTO POSITION AND THE UNIT IS IN THE UNOCCUPIED MODE, THE TLO SHALL FUNCTION TO PLACE THE RTU IN THE OCCUPIED MODE FOR 2 HOURS (ADJUSTABLE).
- PROOF OF FAN OPERATION: FAN RUN STATUS SHALL BE VERIFIED VIA A CURRENT SENSOR AT THE FAN MOTOR. COMMAND FAN OFF IN THE EVENT OF A FAN FAILURE ALARM.
- ZONE DAMPER HEATING/COOLING MODE: THE HEATING/COOLING CONTROL MODE FOR INDIVIDUAL ZONES SHALL BE DETERMINED BY THE ZONE DAMPER APPLICATION SPECIFIC CONTROLLER (ASC). THE CAC SHALL BROADCAST THE SYSTEM SUPPLY AIR TEMPERATURE TO THE ZONE ASC EVERY 15 SECONDS (ADJUSTABLE). THE ZONE ASC SHALL COMPARE THE BROADCAST SYSTEM SUPPLY AIR TEMPERATURE TO ZONE SPACE TEMPERATURE AND ZONE SPACE TEMPERATURE SETPOINT. IF THE SYSTEM SUPPLY AIR TEMPERATURE IS:
  - $\leq$  THE ZONE SPACE TEMPERATURE THE ZONE CONTROL MODE IS COOLING.
  - $>$  THE ZONE SPACE TEMPERATURE + 10°F (ADJUSTABLE) THE ZONE CONTROL MODE IS HEATING.IF THE SYSTEM SUPPLY AIR TEMPERATURE IS BETWEEN THE ZONE SPACE TEMPERATURE AND ZONE SPACE TEMPERATURE + 10°F (ADJUSTABLE), AND THE ZONE SPACE TEMPERATURE IS:
  - $>$  THE COOLING SPACE TEMPERATURE SETPOINT THE CONTROL MODE IS HEATING.
  - $\leq$  THE HEATING SPACE TEMPERATURE SETPOINT THE CONTROL MODE IS COOLING.E. BETWEEN THE HEATING AND COOLING SPACE TEMPERATURE SETPOINTS THE CONTROL ACTION DOES NOT CHANGE.
- SYSTEM HEATING OR COOLING MODE ZONE VOTING: EACH ZONE DAMPER ASC SHALL HAVE ONE VOTE (ADJUSTABLE). IN THE OCCUPIED AND UNOCCUPIED MODE, EACH ZONE SHALL HAVE ONE VOTE (ADJUSTABLE). THE CAC SHALL DETERMINE IF EACH ZONE IS ELIGIBLE TO VOTE OR IS RESTRICTED FROM VOTING. A VOTING RESTRICTED ZONE CONTINUES TO OPERATE AND COMMUNICATE NORMALLY. RESTRICTED AND UNRESTRICTED ZONE VOTING STATUS SHALL BE DISPLAYED ON THE SYSTEM GRAPHIC.
  - A ZONE SHALL BE ELIGIBLE TO VOTE IF:
    - A ZONE IS IN COMMUNICATION WITH THE CAC.
    - A ZONE HAS A VALID ZONE SPACE TEMPERATURE READING.
    - A ZONE IS NOT TAGGED FOR NO VOTE BY THE CAC.
    - A ZONE SHALL BE RESTRICTED FROM VOTING IF:
      - D. SYSTEM IS NOT IN MORNING WARM-UP OR PRECOOL MODES.
      - E. THE ZONE IS RECEIVING THE COMMANDED SUPPLY AIRFLOW.
      - F. THE ZONE SPACE TEMPERATURE IS FURTHEST AWAY FROM SETPOINT OF ALL VOTING ZONES RECEIVING THE COMMANDED SUPPLY AIRFLOW.
      - G. THE ZONE SPACE TEMPERATURE IS  $>$  3°F (ADJUSTABLE) FROM SPACE TEMPERATURE SETPOINT FOR 60 MINUTES (ADJUSTABLE).
      - A VOTE RESTRICTED ZONE SHALL BE MADE ELIGIBLE FOR VOTING IF:
        - H. THE ZONE RETURNS TO WITHIN 1°F (ADJUSTABLE) OF ITS ACTIVE SPACE TEMPERATURE SETPOINT.
        - I. THE SYSTEM ENTERS THE UNOCCUPIED MODE.
  - SYSTEM HEATING OR COOLING MODE ZONE CALLS: AFTER THE ZONE HEATING/COOLING MODE OF THE ZONE DAMPER ASC IS INITIATED, THE STRENGTH OF ITS CALL FOR HEATING OR COOLING SHALL BE DETERMINED AS FOLLOWS:
    - A. CALL FOR COOLING: A ZONE OBTAINS A CALL FOR COOLING STATUS IF ELIGIBLE TO VOTE, AND ITS ZONE SPACE TEMPERATURE IS  $>$  1°F (ADJUSTABLE) ABOVE THE ACTIVE COOLING SPACE TEMPERATURE SETPOINT + 0.5°F (ADJUSTABLE).
    - B. STRONG CALL FOR COOLING: A ZONE OBTAINS A STRONG CALL FOR COOLING STATUS IF IT IS ELIGIBLE TO VOTE, AND ITS ZONE SPACE TEMPERATURE IS  $>$  2°F (ADJUSTABLE) ABOVE THE ACTIVE COOLING SPACE TEMPERATURE SETPOINT. A ZONE LOSES ITS STRONG CALL FOR COOLING CALLER STATUS IF IT BECOMES A RESTRICTED VOTER OR IF ZONE SPACE TEMPERATURE IS  $<$  THE ACTIVE COOLING SPACE TEMPERATURE SETPOINT + 1°F (ADJUSTABLE).
    - C. CALL FOR HEATING – ZONE WITHOUT LOCAL HEAT: A ZONE OBTAINS A CALL FOR HEATING STATUS IF IT IS ELIGIBLE TO VOTE, AND ITS ZONE SPACE TEMPERATURE IS  $>$  1°F (ADJUSTABLE) BELOW THE ACTIVE HEATING SPACE TEMPERATURE SETPOINT. A ZONE LOSES ITS CALL FOR HEAT STATUS IF IT BECOMES A RESTRICTED VOTER OR IF ITS ZONE SPACE TEMPERATURE IS  $>$  THE ACTIVE HEATING SPACE TEMPERATURE SETPOINT – 0.5°F (ADJUSTABLE).
    - D. STRONG CALL FOR HEATING – ZONE WITHOUT LOCAL HEAT: A ZONE OBTAINS A STRONG CALL FOR HEAT STATUS IF IT IS ELIGIBLE TO VOTE, AND ITS ZONE SPACE TEMPERATURE IS  $>$  2°F (ADJUSTABLE) BELOW THE ACTIVE HEATING SPACE TEMPERATURE SETPOINT. A ZONE LOSES ITS STRONG CALL FOR HEAT STATUS IF IT BECOMES A RESTRICTED VOTER OR IF ITS ZONE SPACE TEMPERATURE IS  $>$  THE ACTIVE HEATING SPACE TEMPERATURE SETPOINT – 1°F (ADJUSTABLE).
  - SYSTEM HEATING AND COOLING MODES: WHEN THE OCCUPIED MODE INITIATES, THE INITIAL SYSTEM HEATING OR COOLING MODE SHALL BE DETERMINED BY THE OUTDOOR DEWPOINT TEMPERATURE. GLOBAL OUTDOOR AIR TEMPERATURE AND HUMIDITY SENSORS SHALL BE USED TO CALCULATE THE OUTDOOR AIR DEWPOINT TEMPERATURE. THE COOLING MODE SHALL BE ACTIVE WHEN THE DEWPOINT TEMPERATURE IS 50°F (ADJUSTABLE) OR GREATER AND THE HEATING MODE SHALL BE ACTIVE WHEN THE DEWPOINT IS BELOW 50°F (ADJUSTABLE). AFTER THE INITIAL HEATING/COOLING MODE IS DETERMINED, THE CAC SHALL SCAN ALL ZONES CONTINUOUSLY (ONCE EVERY 15 SECONDS – ADJUSTABLE) AND DETERMINE THE QUANTITY AND WEIGHT OF ALL ZONE CALLS FOR HEATING AND COOLING VOTING. THE GREATER NUMBER OF VOTES SHALL DETERMINE THE SYSTEM HEATING/COOLING MODE. THE CAC SHALL REQUIRE A MINIMUM OF 2 (ADJUSTABLE) OPPOSITE CALLS TO CHANGE OVER AND ALL CURRENT CALLERS MUST BE SATISFIED BEFORE THE SYSTEM CHANGES FROM THE CURRENT HEATING/COOLING MODE. HEATING/COOLING CHANGEOVER SHALL ALSO OCCUR IF ENOUGH OPPOSITE STRONG CALLS EXIST. THE CAC SHALL REQUIRE A MINIMUM OF 2 (ADJUSTABLE) OPPOSITE STRONG CALLS TO CHANGE OVER. ALL CURRENT CALLERS DO NOT HAVE TO BE SATISFIED BEFORE THE SYSTEM IS ALLOWED TO CHANGE OVER. A 15 MINUTE (ADJUSTABLE) MINIMUM RUN TIME BETWEEN CHANGE OVER SHALL BE PROVIDED. THE MINIMUM CHANGE OVER RUN TIME ELAPSED SHALL BE DISPLAYED ON THE SYSTEM GRAPHIC.
  - SPACE TEMPERATURE SETPOINTS: THERE SHALL BE SEPARATE OCCUPIED AND UNOCCUPIED MODE COOLING AND HEATING SPACE TEMPERATURE SETPOINTS.
    - A. REFER TO THE DESIGN CONDITIONS SCHEDULE FOR SETPOINT VALUES.
  - SPACE HUMIDITY SETPOINTS: THERE SHALL BE SEPARATE OCCUPIED AND UNOCCUPIED MODE HUMIDITY SETPOINTS.
    - A. THE OCCUPIED MODE SETPOINT SHALL BE 60% RH (ADJUSTABLE).
    - B. THE UNOCCUPIED MODE SETPOINT SHALL BE 65% RH (ADJUSTABLE).
  - SUPPLY FAN CONTROL: FAN SPEED SHALL BE CONTROLLED TO PROVIDE CODE REQUIRED TWO STAGE HIGH/LOW FAN SPEED AIR VOLUME CONTROL AND CONSTANT AIR VOLUME AT HIGH/LOW STAGED AIR VOLUME SETPOINTS AS FILTERS LOAD FROM A CLEAN TO A DIRTY CONDITION AT THE FAN SPEED STAGE AND MAINTAIN ZONE DAMPER DUCT STATIC PRESSURE.
    - A. A STARTER/VFD/ECM SHALL CONTROL FAN AIR VOLUME AT HIGH/LOW FAN SPEED SETPOINTS FOR COOLING SPACE TEMPERATURE CONTROL.
    - B. AN AIRFLOW STATION LOCATED IN THE SUPPLY AIR DUCT UPSTREAM OF THE FIRST BYPASS DAMPER AND ZONE DAMPER SHALL PROVIDE AN INPUT SIGNAL TO THE CAC. THE CAC SHALL UTILIZE THE INPUT SIGNAL TO PROVIDE AN ANALOG SIGNAL TO THE VFD/ECM FOR CONTROL OF FAN SPEED TO MAINTAIN THE SA AIR FLOW SETPOINT AS FILTERS LOAD FROM A CLEAN TO DIRTY CONDITION AT THE FAN SPEED STAGE. WHEN AIRFLOW FALLS BELOW SETPOINT FAN SPEED SHALL SLOWLY INCREASE TO MAINTAIN SETPOINT. WHEN AIRFLOW RISES ABOVE SETPOINT, FAN SPEED SHALL SLOWLY DECREASE TO MAINTAIN SETPOINT.
    - C. A DUCT MOUNTED STATIC PRESSURE SENSOR LOCATED IN THE SUPPLY AIR DUCT DOWNSTREAM OF THE FIRST BYPASS DAMPER BUT UPSTREAM OF THE FIRST ZONE DAMPER ZONE SHALL PROVIDE AN INPUT SIGNAL TO THE CAC AND THE CAC SHALL UTILIZE THE INPUT SIGNAL TO MODULATE THE BYPASS DAMPER OPEN AND CLOSED AND MAINTAIN DAMPER ZONE DUCT PRESSURE SETPOINT.
    - D. THE TEST AND BALANCE CONTRACTOR SHALL DETERMINE THE INITIAL HIGH/LOW SPEED SF VFD SETPOINTS AND CORRESPONDING DUCT STATIC PRESSURE SETPOINTS WITH CLEAN FILTERS.
  - COOLING MODE TEMPERATURE CONTROL.
    - A. GENERAL: IN THE COOLING MODE, THE COOLING CONTROL SEQUENCE SHALL BE INITIATED. WHEN THE RTU SF IS PROVED OPERATIONAL, A COIL LEAVING AIR TEMPERATURE SENSOR SHALL BE UTILIZED TO MAINTAIN A CONSTANT LEAVING AIR TEMPERATURE SETPOINT (SEE EQUIPMENT SCHEDULE). THE COOLING MODE SHALL REMAIN ACTIVE UNTIL THE HEATING MODE IS INITIATED.
    - B. COOLING CAPACITY CONTROL: CONDENSING SECTION CAPACITY AND SUPPLY FAN HIGH/LOW AIR VOLUME STAGING SHALL BE CONTROLLED TO MAINTAIN SETPOINT. THE INITIAL SF SPEED SETPOINT SHALL BE HIGH SPEED. WHEN LEAVING AIR TEMPERATURE RISES ABOVE SETPOINT, THE CU SHALL BE SLOWLY STAGED UPWARD IN CAPACITY STEPS PROPORTION TO THE OFFSET BETWEEN LEAVING AIR TEMPERATURE SETPOINT AND THE LEAVING AIR TEMPERATURE. WHEN THE LEAVING AIR TEMPERATURE FALLS TOWARDS SETPOINT, CAPACITY STEPS SHALL BE SLOWLY STAGED OFF IN PROPORTION TO THE OFFSET BETWEEN THE LEAVING AIR TEMPERATURE SETPOINT AND THE LEAVING AIR TEMPERATURE. THE SF LOW SPEED SETPOINT SHALL BE THE LAST STAGE OF SYSTEM STAGING CONTROL. HOT GAS BYPASS SHALL PROVIDE INHERENT MODULATING CAPACITY CONTROL BETWEEN CU FIRST STAGE AND CU OFF CAPACITY STAGES. THE COOLING MODE SHALL REMAIN ACTIVE AND THE CU ENABLED UNTIL THE HEATING MODE IS INITIATED.
  - DEHUMIDIFICATION MODE CONTROL.
    - A. OCCUPIED MODE.
      - A. GENERAL: IN THE OCCUPIED COOLING MODE, THE SPACE HUMIDITY LEVEL SHALL BE MONITORED. IF A HIGH HUMIDITY CONDITION IS INDICATED FOR AT LEAST 15 MINUTES (ADJUSTABLE), THE DEHUMIDIFICATION SEQUENCE SHALL BE INITIATED.
      - b. REHEAT CONTROL: MAXIMUM CONDENSING SECTION STAGING SHALL BE ENABLED AND ELECTRIC HEAT IN THE REHEAT POSITION SHALL MODULATE OR STAGE CAPACITY (SEE HEATING SPACE TEMPERATURE CONTROL) TO MAINTAIN A 70°F SPACE TEMPERATURE SETPOINT UNTIL THE SPACE HUMIDITY FALLS BELOW SETPOINT. THE SYSTEM SHALL EXIT THE DEHUMIDIFICATION MODE WHEN THE SPACE HUMIDITY LEVEL IS BELOW SETPOINT FOR 15 MINUTES (ADJUSTABLE). IF THE SPACE HUMIDITY LEVEL HAS NOT RETURNED TO NORMAL AFTER 1 HOUR (ADJUSTABLE), AN ALARM SHALL BE GENERATED INDICATING THIS CONDITION.
    - B. UNOCCUPIED MODE.
      - a. GENERAL: IN THE UNOCCUPIED COOLING MODE, THE SPACE HUMIDITY LEVEL SHALL BE MONITORED. IF A HIGH HUMIDITY CONDITION IS INDICATED FOR AT LEAST 15 MINUTES (ADJUSTABLE) AND IT HAS BEEN AT LEAST 1 HOUR (ADJUSTABLE) SINCE ENTERING THE UNOCCUPIED MODE, THE DEHUMIDIFICATION MODE SHALL BE INITIATED.
      - b. REHEAT CONTROL: MAXIMUM CONDENSING SECTION STAGING SHALL BE ENABLED AND ELECTRIC HEAT IN THE REHEAT POSITION SHALL MODULATE OR STAGE CAPACITY (SEE HEATING SPACE TEMPERATURE CONTROL) TO MAINTAIN A 70°F SPACE TEMPERATURE SETPOINT UNTIL THE SPACE HUMIDITY FALLS BELOW SETPOINT. THE SYSTEM SHALL EXIT THE DEHUMIDIFICATION SEQUENCE WHEN THE SPACE HUMIDITY LEVEL IS BELOW SETPOINT FOR 30 MINUTES (ADJUSTABLE). IF THE HIGH HUMIDITY LEVEL HAS NOT RETURNED TO NORMAL AFTER 2 HOURS (ADJUSTABLE), THEN THE CYCLE WILL STOP AND AN ALARM SHALL BE GENERATED INDICATING THIS CONDITION.
      - C. AN ADDITIONAL ALARM SHALL BE PROVIDED IF SPACE HUMIDITY DOES NOT RETURN TO ACCEPTABLE LEVELS FOR A PERIOD OF 24 CONTINUOUS HOURS.
      - D. A LEAVING AIR TEMPERATURE SENSOR SHALL MONITOR ELECTRIC HEAT LEAVING AIR TEMPERATURE (SEE EQUIPMENT SCHEDULE FOR THE MAXIMUM LEAVING AIR TEMPERATURE).
  - HEATING MODE CONTROL.
    - A. GENERAL: IN THE HEATING MODE, WHEN THE RTU SF IS PROVED OPERATIONAL AND THE SPACE TEMPERATURE FALLS BELOW THE HEATING SPACE TEMPERATURE SETPOINT, THE HEATING MODE SHALL BE INITIATED. THE SF SPEED SETPOINT SHALL BE AT HIGH SPEED TO LIMIT SUPPLY AIR TEMPERATURE NO GREATER THAN 85°F. THE HEATING MODE SHALL REMAIN ACTIVE UNTIL THE COOLING MODE IS INITIATED. ELECTRIC HEAT (EH) CAPACITY MAY BE SCHEDULED AS EITHER MODULATING OR STAGED PER THE EQUIPMENT SCHEDULE.
    - B. MODULATING HEAT: WHEN THE SPACE TEMPERATURE FALLS BELOW SETPOINT, THE EH SHALL BE ENABLED AND CAPACITY SHALL BE SLOWLY MODULATED TOWARDS 100% CAPACITY TO MAINTAIN SETPOINT. WHEN THE SPACE TEMPERATURE RISES TOWARDS SETPOINT, EH CAPACITY SHALL BE SLOWLY MODULATED TOWARDS 0% CAPACITY. WHEN THE SPACE TEMPERATURE RISES ABOVE THE SETPOINT, THE EH SHALL BE DISABLED.
    - C. STAGED HEAT: WHEN THE SPACE TEMPERATURE FALLS BELOW SETPOINT, THE EH SHALL BE ENABLED AND EH CAPACITY STAGED UPWARD IN CAPCITY STEPS IN PROPORTION TO THE OFFSET BETWEEN THE SPACE TEMPERATURE SETPOINT AND THE SPACE TEMPERATURE. WHEN THE SPACE TEMPERATURE RISES TOWARDS SETPOINT, EH CAPACITY STEPS SHALL BE STAGED OFF IN PROPORTION TO THE OFFSET BETWEEN THE SPACE TEMPERATURE SETPOINT AND THE SPACE TEMPERATURE. WHEN THE SPACE TEMPERATURE RISES ABOVE SETPOINT THE EH SHALL BE DISABLED.
  - VENTILATION OUTDOOR AIR FLOW CONTROL: WHEN THE RTU SF IS OFF, THE OUTDOOR AIR DAMPER SHALL CLOSE. WHEN THE RTU SF IS PROVED OPERATIONAL, THE OUTDOOR DAMPER SHALL OPEN. THE INITIAL TEST AND BALANCE SHALL DOCUMENT THE OUTDOOR AIR FLOW (SEE EQUIPMENT SCHEDULE FOR AIR FLOW QUANTITY). A DAMPER END SWITCH SHALL MONITOR THE OUTDOOR AIR DAMPER CLOSED POSITION AND PROVIDE AN ALARM IF THE DAMPER IS NOT FULLY CLOSED WHEN THE DAMPER HAS BEEN COMMANDED CLOSED.
  - ZONE DAMPER CONTROL: A SPACE SENSOR SHALL MODULATE A PRESSURE DEPENDANT ZONE DAMPER TO MAINTAIN SPACE TEMPERATURE.
  - EXHAUST FAN START/STOP CONTROL: EXHAUST FANS (EF) SHALL BE INTERLOCKED WITH THE RTU AS INDICATED IN THE EXHAUST FAN SCHEDULE. EXHAUST FANS SHALL BE ON WHENEVER THE RTU IS ON AND OFF WHEN THE RTU IS OFF. EXHAUST FAN STATUS SHALL BE MONITORED AND ALARMED.
  - FIRE/SMOKE CONTROL: THE UNIT SHALL BE INTERLOCKED UNDER DIVISION 28 WITH DUCT MOUNTED SUPPLY AIR SMOKE DETECTORS (NUMBER OF DETECTORS PER UNIT AS SHOWN ON THE BUILDING FLOOR PLANS). UPON SENSING PRODUCTS OF COMBUSTION, THE SMOKE DETECTOR SHALL SIGNAL THE BUILDING FIRE ALARM SYSTEM. THE FIRE ALARM SYSTEM SHALL IN-TURN ACTIVATE THE FIRE ALARM SHUTDOWN RELAY(S) WHICH SHALL BE INTERLOCKED WITH THE RTU SF STARTER/VFD/ECM, TO SHUT DOWN THE UNIT, PREVENTING UNIT OPERATION WHEN AN RTU SMOKE DETECTOR ALARM CONDITION EXISTS. PROVIDE A SECOND SET OF NORMALLY OPEN AUXILIARY CONTACTS IN THE FIRE ALARM SHUTDOWN RELAY AND IN THE RTU SF STARTER/VFD/ECM WRED TO ALL SMOKE AND FIRE/SMOKE DAMPERS ASSOCIATED WITH THE UNIT AS LOCATED ON THE PLANS. ALL FIRE/SMOKE AND SMOKE DAMPERS SHALL CLOSE WHENEVER THE RTU IS OFF. WHEN THE RTU IS SHUT DOWN, ALL ASSOCIATED EXHAUST AND OUTDOOR AIR DAMPERS SHALL CLOSE AND EXHAUST FANS SHALL STOP.
  - POWER FAILURE: UPON A LOSS OF POWER THE RTU SHALL SHUT DOWN. WHEN POWER IS RESTORED, THE RTU SHALL RESTART AUTOMATICALLY. RTU START-UP SHALL BE STAGGERED TO LIMIT KW DEMAND.
  - SAFETIES:
    - A. A CONDENSATE DRAIN PAN OVERFLOW LEVEL SENSOR SHALL BE PROVIDED IN THE COOLING COIL DRAIN PAN. IN THE EVENT OF A HIGH CONDENSATE LEVEL SAFETY TRIP, THE RTU SHALL SHUT DOWN AND A HIGH PRIORITY ALARM SHALL BE GENERATED FOR A SERVICE/MAINTENANCE CALL.
    - B. A HIGH DUCT STATIC PRESSURE SWITCH SHALL BE PROVIDED DOWNSTREAM OF THE RTU SF NEAR THE UNIT. IN THE EVENT OF A HIGH DUCT PRESSURE SAFETY TRIP, THE RTU SHALL SHUT DOWN AND A HIGH PRIORITY ALARM SHALL BE GENERATED FOR A SERVICE/MAINTENANCE CALL.
  - MONITORING POINTS: THE BMS SHALL MONITOR EQUIPMENT AND PROVIDE A REAL-TIME GRAPHICAL DISPLAY OF THE STATUS AND VALUE OF ALL RTU, AND EF POINTS AT THE OPERATOR WORKSTATION. THE RTU OPERATING STATUS AND OCCUPANCY MODE SHALL BE DISPLAYED (OCCUPIED/UNOCCUPIED/OVERRIDE) AS WELL AS THE ACTIVE CONTROL MODE OF OPERATION (COOLING/DEHUMIDIFICATION/HEATING/OPTIMUM START, ETC). IN ADDITION, SAFETY AND ALARM STATUS SHALL BE DISPLAYED. AN OVERALL FLOOR PLAN OF THE AREA SERVED BY EACH RTU SHALL BE PROVIDED THAT DISPLAYS THE LOCATION OF EACH RTU AND THE TEMPERATURE AND HUMIDITY AT EACH ROOM SENSOR. GRAPHICALLY INDICATE THE LIMITS OF THE AREA THAT EACH UNIT SERVES.
  - VFD/ECM DRIVE OPERATING PARAMETERS SHALL BE OBTAINED THROUGH A COMMUNICATIONS BUS INTERFACE CARD AND DISPLAYED ON THE RTU GRAPHIC AT THE OPERATOR WORKSTATION. THE INTERFACE CARD PROVIDED WITH THE DRIVE SHALL BE COMPATIBLE WITH AND FULLY COMMUNICATE WITH THE BMS.
  - ALARMS: PROVIDE THE FOLLOWING ALARMS AT THE OPERATORS WORKSTATION:
    - A. SF COMMAND MISMATCH: FAN START COMMAND ISSUED AND STATUS NOT PROVED AFTER A 60 SECOND DELAY (ADJUSTABLE); FAN STOP COMMAND ISSUED AND RUN STATUS CONTINUES TO BE SENSED, AFTER A 60 SECOND DELAY (ADJUSTABLE); UNAUTHORIZED FAN START/STOP DURING UNOCCUPIED AND OCCUPIED MODES.
    - B. GENERAL RTU FAILURE.
    - C. GENERAL VFD/ECM FAILURE.
    - D. VFD/ECM ALARMS PROVIDED THRU THE NETWORK CONNECTION.
    - E. HIGH ZONE SPACE TEMPERATURE IN COOLING MODE – SPACE SETPOINT + 3°F (ADJUSTABLE) FOR LONGER THAN 15 MINUTES (ADJUSTABLE).
    - F. HIGH ZONE SPACE TEMPERATURE IN COOLING MODE – SPACE SETPOINT NOT MET WHEN THE CONDENSING SECTION IS AT 100% CAPACITY FOR LONGER THAN 30 MINUTES (ADJUSTABLE).
    - G. HIGH REHEAT LEAVING AIR TEMPERATURE IN COOLING MODE – SETPOINT + 5°F (ADJUSTABLE) FOR LONGER THAN 15 MINUTES (ADJUSTABLE).
    - H. LOW REHEAT LEAVING AIR TEMPERATURE IN COOLING MODE – SETPOINT – 5°F (ADJUSTABLE) FOR LONGER THAN 15 MINUTES (ADJUSTABLE).
    - I. LOW ZONE SPACE TEMPERATURE IN HEATING MODE – SPACE SETPOINT – 3°F (ADJUSTABLE) FOR LONGER THAN 15 MINUTES (ADJUSTABLE).
    - J. LOW ZONE SPACE TEMPERATURE IN HEATING MODE – SPACE SETPOINT NOT MET WHEN EH IS AT 100% CAPACITY FOR LONGER THAN 30 MINUTES (ADJUSTABLE).
    - K. OCCUPIED HIGH SPACE HUMIDITY – ABOVE SETPOINT AFTER 1 HOUR.
    - L. UNOCCUPIED HIGH SPACE HUMIDITY – SPACE SETPOINT + 5% RH (ADJUSTABLE) AFTER 2 HOURS (ADJUSTABLE).
    - M. UNOCCUPIED HIGH SPACE HUMIDITY – SPACE SETPOINT +5% RH (ADJUSTABLE) AFTER 24 CONTINUOUS HOURS (ADJUSTABLE).
    - N. OUTDOOR AIR DAMPER COMMAND MISMATCH: DAMPER COMMANDED CLOSED AND STATUS NOT PROVED AFTER A 30 SECOND DELAY (ADJUSTABLE).
    - O. DIRTY FILTER CONDITION – SEE FILTER SCHEDULE FOR SETPOINT.
    - P. EF FAN COMMAND MISMATCH: FAN START COMMAND ISSUED AND STATUS NOT PROVED AFTER A 60 SECOND DELAY (ADJUSTABLE); FAN STOP COMMAND ISSUED AND RUN STATUS CONTINUES TO BE SENSED, AFTER A 60 SECOND DELAY (ADJUSTABLE); UNAUTHORIZED FAN START/STOP DURING UNOCCUPIED AND OCCUPIED MODES.
    - Q. COOLING CONDENSATE DRAIN PAN OVERFLOW SAFETY INITIATION.
    - R. HIGH DUCT STATIC PRESSURE SAFETY INITIATION – POSITIVE 2.0 IN.W.G SETPOINT (ADJUSTABLE).



## DDC POINT TABLE – ROOFTOP UNIT

INPUTS			OUTPUTS		
POINT	TYPE	DESCRIPTION	POINT	TYPE	DESCRIPTION
1	ANALOG	RTU SUPPLY FAN STATUS	2	DIGITAL	RTU SUPPLY FAN START/STOP
3	ANALOG	COOLING COIL LEAVING AIR TEMPERATURE	4	ANALOG	RTU SUPPLY FAN SPEED
5	ANALOG	SUPPLY AIR TEMPERATURE	6	DIGITAL	CONDENSING SECTION STAGING (ONE POINT PER STAGE)
7	ANALOG	FILTER DIFFERENTIAL PRESSURE	8	DIGITAL	ELECTRIC HEAT STAGING (ONE POINT PER STAGE)
9	DIGITAL	OUTDOOR AIR DAMPER POSITION	10	DIGITAL	OUTDOOR AIR DAMPER POSITION
11	DIGITAL	CONDENSATE DRAIN PAN OVERFLOW	12	DIGITAL	EF START/STOP (ONE POINT PER FAN)
13	ANALOG	SA AIR FLOW (FILTER LOADING CAV CONTROL)	14	ANALOG	BYPASS DAMPER POSITION (ONE POINT PER DAMPER)
15	DIGITAL	EXHAUST FAN STATUS (ONE POINT PER FAN)	16	ANALOG	ZONE DAMPER POSITION (ONE POINT PER DAMPER)
17	ANALOG	ZONE SPACE TEMPERATURE (ONE POINT PER SENSOR)	18	–	–
19	ANALOG	SPACE HUMIDITY	20	–	–
21	DIGITAL	HIGH SUPPLY AIR DUCT PRESSURE	22	–	–
23	ANALOG	SA DUCT STATIC PRESSURE (BYPASS CONTROL)	24	–	–

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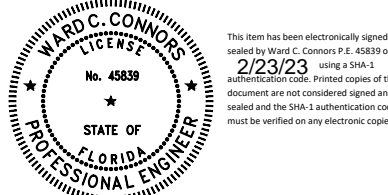
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